## 4.3 Liquid Effluents

Liquid effluents were historically released in a number of ways, including via the sanitary sewage and storm water drainage systems. Eventually, effluent material that was not otherwise held up or recovered through wastewater treatment and recovery systems flowed to one or more of the various site outfalls and ditches and then into either the Big or Little Bayou Creeks, which ultimately discharged to the Ohio River.

In the early 1970s, the Clean Water Act established the NPDES, which administered effluent limitations and water quality requirements for chemical releases. These programs could be administered by the states after Federal authorization. In Kentucky, these were known as KPDES permits. The first one was issued for the recirculating cooling tower blowdown water. Subsequently, a total of 18 outfalls were permitted at the site. Liquid effluent discharge limits for radionuclides were not specifically promulgated by EPA, but were always required and published under the AEC and ERDA regulations and later DOE orders as MPC or RCGs in water. Despite the discharge restrictions, it is clear that over the years, enough radionuclides have been released to create legacy environmental contamination; the existence of legacy contamination has been confirmed through environmental sampling data.

**Process and Stormwater Flow Near Outfall K001 - 1999**

The most significant liquid radiological effluent source was the C-400 decontamination building. This building contained a variety of systems and processes for isotopic recovery and decontamination of process equipment and scrap metal, as well as the sitewide laundry. Given the nature of operations in this facility, managing the various types and quantities of liquid wastes generated was a significant challenge. These wastes included TCE from degreasing operations, contaminated liquids from cleaning operations, and various contaminated raffinate solutions from uranium, neptunium, and technetium recovery operations. For radionuclides, essentially all isotopes at the site were present in various portions of this facility and in its liquid waste streams, including uranium, neptunium, plutonium, thorium, and technetium.

Uranium recovery operations in this building were used to recover valuable uranium materials and also to reduce the uranium concentration in cleaning liquids to acceptable levels before release. Neptunium and technetium recovery campaigns were also conducted at various times during Plant operations. Liquid effluents from these operations and others that generated contaminated liquids were sampled before being released to drainage systems. If the applicable limits were not met, the material was either put in drums and stored or routed back through the uranium recovery process. Liquids that met the discharge limits were released to the North-South Diversion Ditch and outfalls, depending on the piping sequence. In 1972, Union Carbide reported that from 1956 to 1970, the uranium recovery system discharged a total of 4000 grams of neptunium and 191 grams of plutonium to the environment. A 1977 internal memorandum indicated that the then-current method of estimating uranium discharges significantly underestimated the releases.

A review of past correspondence identified instances where specific decisions were made to discharge waste materials containing uranium, transuranics, and fission products directly into local ditches. In 1963, the AEC authorized a request by the site to release thorium-, neptunium-, and uranium-contaminated raffinate solution being stored in drums to the Ohio River via a diversion ditch. The request stated that the discharge would be controlled to keep the concentration of the materials in the river below permissible limits. The request was granted by the AEC, effectively allowing the point of compliance for liquid effluents to be the Ohio River, rather than local ditches and streams. This decision may have been a misapplication of AEC regulations concerning maximum permissible concentrations of liquid effluents in unrestricted areas. This type of approach has contributed to elevated isotopic concentrations of uranium, thorium, transuranics, and fission products found in ditches and outfalls both on and near the site today.

One of the other large sources of contamination from C-400 was the massive amount of TCE used for degreasing operations. TCE contamination emanating

from this building was significant and probably occurred over a number of years. For example, in 1986 while upgrading an unfiltered storm water line leading to Outfall K015, a subcontractor discovered a large volume of TCE during an excavation. It is not known how long this release had been occurring, and the quantity of TCE released was never determined. Normal operations presented numerous possibilities for TCE releases in addition to those that have been documented. For example, TCE releases are likely to have been associated with C-720 compressor pit operations, as evidenced in part by the existence of the southwest TCE plume.

Interviews with past workers confirmed the accepted practice of disposal of TCE down building drains not only in C-400, but also at many other process and support facilities on site. This practice occurred from the early Plant operations through the 1970s. Workers also confirmed that TCE was periodically dumped onto the ground at locations near numerous process and support buildings and during cleaning operations in the switchyards. There was apparently a belief that the material would evaporate quickly and cause no harm to the environment.

The outdoor storage and placement of contaminated waste and scrap that began in the late 1950s (e.g., Drum Mountain and scrap yards) has continuously contributed to the spread of contamination through surface water runoff. Contaminants settled in onsite ditches and streams. As a result, in the late 1980s efforts were undertaken to characterize and plan for remedial measures to address these contaminants. Limited removal and access controls were established in the 1990s. The Phase I Oversight investigation provided additional characterization of the contaminants in streams and ditches in the vicinity of the Plant.

**Drum Mountain**

From the beginning of PGDP operations, the C-615 sewage treatment plant treated sanitary wastewater (sewage and sink wastes) from process and support buildings. Radiological components of treated water caused the sewage sludge to be contaminated with uranium. Subsequently, this material was unknowingly spread at various locations at the site, creating contamination control problems. In 1977, the C-616 wastewater treatment plant came on line. Major liquid effluent streams that feed into the North-South Diversion Ditch were then routed by a lift station to the 616 facility, resulting in a significant improvement in water quality in local streams.

The major component of liquid process waste during early Plant operations was the recirculating cooling water—approximately 500,000 gallons per day, with a 20 ppm concentration of chromium. An additional 80,000 gallons per day of cooling and scrubber tower water contained soluble fluorides. The cooling water was pumped to Little Bayou. At one time, the Little Bayou was a dead stream in parts and was actually colored yellow by the chromium from the cooling water. In response to changing Federal requirements for pollution control, the use of chromium in cooling water was phased out.

## 4.4 Atmospheric Releases of Radioactivity and Fluorine/ Fluorides

- *Stack Emissions*
- *Accidental Releases*
- *Diffuse and Fugitive Emissions*
- *Planned Emissions*

Radioactive and fluorine/fluoride air emissions to the atmosphere began with startup in 1952 and have continued to the present from USEC operations regulated by NRC. The air emissions from the site were from process stacks, diffuse and fugitive emission sources, accidental releases, and a limited number of planned releases.

### Stack Emissions

The site did not perform stack monitoring until the mid-1970s, so the actual quantities of radionuclides released to the environment from routine operations before that time are unknown. From 1959 to 1974, the air emission reports consisted of ambient air monitoring.